

# VACUUM EXCAVATION BEST PRACTICE & GUIDELINE

## GENERAL DOCUMENT



**Gas Technology Institute**  
1700 S. Mount Prospect Rd.  
Des Plaines, Illinois 60018  
[www.gastechnology.org](http://www.gastechnology.org)

Version 10  
January 2012

The preliminary information contained within this report is to be considered in draft form only. All of this information contained herein is subject to further review.

## Legal Notice

This information was prepared by Gas Technology Institute ("GTI") for GTI's Keyhole Consortium Project Sponsor's. Neither GTI, the members of GTI, the Sponsor(s), nor any person acting on behalf of any of them:

- a. Makes any warranty or representation, express or implied with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately-owned rights. Inasmuch as this project is experimental in nature, the technical information, results, or conclusions cannot be predicted. Conclusions and analysis of results by GTI represent GTI's opinion based on inferences from measurements and empirical relationships, which inferences and assumptions are not infallible, and with respect to which competent specialists may differ.
- b. Assumes any liability with respect to the use of, or for any and all damages resulting from the use of, any information, apparatus, method, or process disclosed in this report; any other use of, or reliance on, this report by any third party is at the third party's sole risk.

## **VACUUM EXCAVATION BEST PRACTICE & GUIDELINE:**

### **Definition:**

Vacuum excavation is defined as a means of soil extraction through vacuum when using pressurized water or air for breaking ground. This method of excavation is commonly referred to as “soft excavation technology” and is commonly accepted as being equivalent or safer than hand digging within the “tolerance zone” around underground facilities.

### **Practice Statement:**

Vacuum excavation is an efficient, safe and effective alternative to hand digging within the designated tolerance zone when used appropriately. Use of the equipment must follow State/Provincial Laws and/or Local Ordinances.

### **Practice Description:**

The safe exposure of underground facilities within the tolerance zone is essential to damage prevention. Site conditions may make the use of hand tools to expose underground facilities difficult or even impractical. Vacuum excavation is often an appropriate alternative. Unless specifically allowed by law, locates must be obtained prior to the commencement of work.

Many underground facility owners/operators have specific criteria for safe excavation/exposure practices around their facilities. Some underground facility owners/operators accept vacuum excavation as equivalent to hand excavation for exposing their facilities and others have restrictions on its use.

Vacuum excavation is an appropriate method of excavating safely around underground facilities provided that:

1. The vacuum excavation equipment has been specifically designed and engineered by the excavating equipment manufacturer for non-destructive excavating around buried infrastructure.
2. The equipment is operated in accordance with the manufacturers operating instructions.
3. The vacuum excavation equipment is operated in accordance with practices that provide appropriate levels of worker and public safety and prevent damage to buried facilities
4. A documented company Safety program is in place and available for review upon request by a representative of a facility owner / operator.
5. Documented vacuum excavation Safe Work Practices and Job Procedures are in place and available for review upon request by a representative of a facility owner / operator.
6. Use of the equipment follows the documented Safe Work Practices and Job Procedures.
7. The documented Safe Work Practices and Job Procedures meet facility owner / operator guidelines.
8. Only Competent and Qualified Workers operate the equipment.
9. The tools used (dig wand / vacuum tube) have been specifically designed for excavating around buried facilities (e.g. rubberized coating on dig wand and rubberized sleeve attached to the end of the vacuum tube).
10. Use of the equipment complies with state/provincial laws and/or local ordinances, and facility owner/operator restrictions.

### **Operator Competency:**

Vacuum excavation equipment shall only be operated by a “Competent Person” as defined by OSHA. The operator must have the knowledge, training and experience to perform the work, be

familiar with OSHA and the regulations that apply to the work and have knowledge of all potential and actual danger to health and safety in the workplace. It is a best practice that workers have training recognized by industry, defined safe work practices, manufacturer's recommended procedures specific to the equipment they are operating, and training specific to any known facilities in the area of excavation.

Recommended minimum training requirements for qualified operators of vacuum excavation equipment include, but are not limited to:

- a. OSHA 10-Hour Construction Industry
- b. First Aid
- c. CPR
- d. Haz Woper
- e. Traffic Protection
- f. Fall Protection
- g. Electrical Awareness
- h. Equipotential Bonding
- i. Confined Space
- j. Hydrovac Operator Competency and Equipment Training
- k. Inspection Training
- l. Excavation Safety (OSHA subpart P)
- m. MSDS

#### **Facility Owner / Operator Acceptance:**

Each utility has specific criteria for safe excavation in the vicinity of their facilities. Some utilities view vacuum excavation as the equivalent to hand digging when exposing their facilities and others have restrictions on its use. It is recommended that excavators contact facility owners / operators to determine the extent of their restrictions for the use of this method of excavation around their facilities.

#### **Guideline for Using Vacuum Excavation Equipment in the Vicinity of Pipelines and Energized Cables:**

**Note:** For procedures for using hydrovac excavation in the vicinity of electric distribution lines see the E&USA Safe Practice Guide "*Excavating with Hydrovacs in the Vicinity of Underground Electrical Plant*"

The following procedures shall be followed at all times when excavating with vacuum excavation technology within the "tolerance zone" of underground facilities:

1. Unless specifically allowed by law, an excavator using vacuum excavation equipment shall obtain locates prior to the commencement of work.
2. Only a Competent and Qualified Worker shall operate vacuum excavation equipment.
3. When pressurized water wands are used, the maximum water pressure to be used at any time with a straight tip nozzle<sup>1</sup> during excavation in public roads or easements shall be 2,500psi. Below a depth of 18" the water pressure to be used at any time with a straight tipped nozzle during excavation shall be reduced to a maximum of 1,500psi. All

pressure measurements are to be monitored using a pressure gauge mounted on the excavation machine.

4. The maximum water pressure to be used at any time with a spinning nozzle<sup>ii</sup> during excavation shall be 3,000psi. When a spinning tip nozzle is used, pressure measurements are to be monitored using a pressure gauge mounted on the excavation machine.
5. The pressurized air or water wands shall never remain motionless during excavation. Aiming directly at the underground facilities shall be avoided at all times.
6. A distance of 8" shall be maintained between the end of the pressure wand nozzle and the underground facility and / or subsoil. The nozzle shall never be inserted into the subsoil while excavating within the "tolerance zone".
7. Only use vacuum-excavation equipment and pressure wand nozzles that have been specifically designed for use above buried gas lines or other reasonably expected underground gas plant.
8. A device capable of stopping the excavation on demand, like an Emergency Shut-off Device, shall be immediately available at the point of excavation.
9. If heated water is used during excavation, the temperature and pressure of the water shall never exceed 115°F and 2,500psi respectively.
10. If damage to underground facilities and/or coatings on these facilities occurs while using vacuum-excavation technology or any other method of excavation, the excavator shall contact the facility owner/operator.

---

<sup>i</sup> Straight Tip Nozzles – A straight tip nozzle is a single orifice fitting that can be inserted into the end of the wand used with a hydro-excavation machine such as there is a single concentrated jet of water exiting from the tip of the nozzle.

<sup>ii</sup> Spinning Tip Nozzles – A spinning tip nozzle consists of a conically shaped housing that contains a single exit point (to facilitate the flow of the liquid) as well as a rotor insert. The rotor insert has a series of blades such that when liquid is flowing through the nozzle, the rotor is forced to spin around the longitudinal axis of the nozzle. The rotor insert also contains three or more channels that force liquid to flow in different pathways through the rotor insert to the tip of the rotor which, as a result of the high pressure liquid is forced into contact with the nozzle housing. The liquid flowing through the nozzle is dispersed through the tip of the nozzle housing in a conical shape, having an angle of not less than 20°.

## References:

**CGA Best Practices - Version 9.0 "Section 5-32: Vacuum Excavation"**

**"Guideline for Excavation in the Vicinity of Utility Lines" – Ontario Regulation 210/01 Oil and Gas Pipeline Systems. Ontario Regulation 22/04 Electrical Distribution Safety December 2008**